REMARKS

The instant Amendment A is responsive to the Office Action mailed June 29, 2005. Applicants respectfully submit that claims 1-54, 65-76, 81-112, and 139-153 as set forth herein patentably distinguish over the references, and accordingly ask for allowance of claims 1-54, 65-76, 81-112, and 139-153 as set forth herein.

Current Status of the Claims

As of the June 29th mailing date of the Office Action, claims 1-140 were pending in the application, of which:

Claims 55-63 and 113-138 stand withdrawn based on a previous restriction;

Claims 1, 2, 21-24, 26, 27, 30, 31, 34-36, 39-44, 46-49, 53, 64-66, 75-85, 91-96, and 98-112 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Blankenship, U.S. Patent No. 5,278,390 (hereinafter "Blankenship") in view of Kiyohara et al., U.S. Patent No. 4,125,759 (hereinafter "Kiyohara") in further view of Joseph et al., "Electrical Measurements and Heat Input Calculations for the GMAW-P Process" (hereinafter "Joseph");

Claims 3-20, 25, 28, 29, 32, 33, 37, 38, 45, 50, 51, 52, 54, 67-74, 86-90, and 97 are indicated as containing allowable subject matter; and

Claims 139 and 140 are allowed.

The Applied References

The Office Action employs Blankenship as primary reference to show a waveform electric arc welder. The Office Action recognizes that the claims of the present application distinguish over Blankenship at least in calling for control based on the root mean square (RMS) values (*Office Action* at page 3), and therefore proposes to modify Blankenship by Kiyohara which is alleged to show "a short circuit arc welding process ... controlled on the basis of sensing the RMS value of the current during the arcing phase of the process," *Id.*, further modified by Joseph which is alleged to show a suitable approach for computing RMS welding current.

Kiyohara discloses controlling short-circuit welding using the arc current portion of the wave shape. The basic process is shown in Figs. 7(a)-7(d) and col. 6 lines 1-32. Fig. 7(a) plots instantaneous voltage across the weld, from which a separation pulse signal A (Fig. 7(b)) is extracted. Fig. 7(c) plots a signal B corresponding to instantaneous current. Fig. 7(d) plots signal C which includes only the arc current

portions of the weld current separated out from the weld current signal B based on the separation signal A. In an alternate embodiment, signal B is replaced by signal B' corresponding to instantaneous current-squared (*see* col. 9 lines 7-18), which after filtering produces signal C' corresponding to instantaneous arc current-squared which is used for controlling the welder. Alternatively (col. 9 line 56 ff) the filtering can be performed first, followed by the squaring of the remaining arc current component.

Kiyohara does not disclose or fairly teach a controller that computes the RMS value of the current over the waveform. Rather, Kiyohara teaches computing an "RMS" value over only the arc current portion of the waveform. Indeed, Kiyohara teaches away from controlling based on the RMS current taken over the wave form by touting the advantages of controlling based only on the arc current portion of the weld current. The skilled artisan reading Kiyohara would therefore be led away from controlling based on RMS weld parameter values in which the mean is taken over the whole waveform.

Joseph discloses various measures of heat input and power, including a measure employing RMS current and RMS voltage. However Joseph, similarly to Kiyohara, strongly teaches away from controlling based on RMS current or RMS voltage or derivatives thereof. Joseph states:

> Heat input calculations for GMAW-P must be performed using the average of the product of the instantaneous voltage and current over time to ensure accuracy. Using the mean or RMS voltage and current as displayed by most power supply meters can lead to artificially low or high heat input measurements. This in turn can cause defects in applications where heat input is related to mechanical properties and soundness.

Joseph, Section 5.0.

The skilled artisan reading Joseph would be strongly motivated against controlling based on RMS current or RMS voltage or derivatives thereof.

Withdrawn Claims 55-63 and 113-138 are canceled herein

Withdrawn claims 55-63 and 113-138 are canceled herein. However, Applicants reserve the right to prosecute these claims in a future divisional, continuation-in-part, or other related application claiming priority to the present application.

Claims 1-54, 65-76, 81-112, and 139-140 patentably distinguish over the references of record

Claims 139 and 140 are allowed.

Claims 3 and 28 were indicated as containing allowable subject matter, and have been placed into independent form including the limitations of the base claims. Accordingly, it is respectfully submitted that claims 3 and 28 and claims 4-20, 29, 37-39, 44, 45, 49, and 52 that depend therefrom are in condition for allowance.

Claim 1 has been amended to call for, among other elements, digitally constructing a rms signal representing the rms of said weld current over the current waveform period. This amendment is supported in the original specification at least by Fig. 3A and at least at page 26 line 6 through page 27 line 5.

Kiyohara and Joseph both teach away from a controller employing a constructed rms signal representing the rms current over the current waveform period. Accordingly, it is respectfully submitted that claim 1 and claims 2, 21-27, 30-36, 40-43, 46-48, 50, 51, 53, and 54 that depend therefrom are in condition for allowance.

Claim 65 has been amended to incorporate the subject matter of canceled claim 64, and has been further amended to call for an algorithm for processing said digital representations into a current root mean square (rms) signal in which the mean is taken over at least a contiguous current waveform period. In contrast, Kiyohara takes the mean over only the arc current portion of the waveform period. Accordingly, it is respectfully submitted that claim 65 and claims 66-76 and 81-83 that depend therefrom are in condition for allowance.

Claim 84 has been amended to call for a feedback current control loop with an error detector for generating a current control signal based upon the relationship of two signals, the first signal of which includes an actual rms current signal over the whole waveform generated by an algorithm processed by said digital processor. Kiyohara does not generate a current control signal based in part on an rms current signal over the entire waveform. Rather, Kiyohara computes an rms current signal over only the arc current portion of the waveform. Accordingly, it is respectfully submitted that claim 84 and claims 85-94 that depend therefrom are in condition for allowance.

Claim 95 as originally filed calls for converting instantaneous current into a digital representation of the level of said instantaneous weld current, periodically reading and squaring said digital representation at a given rate, summing a number N of said square

digital representation to give a summed value, periodically dividing and summed value by said number N to provide a quotient, and then taking the square root of said quotient to thereby digitally construct a signal rms representing the root mean square of said weld current. Kiyohara analog constructs a signal representing only the "RMS" of the arc current portion of the weld current, which is not a true RMS value and does not represent the rms of the weld current. Both Kiyohara and Joseph strongly teach away from a control method employing a signal rms representing the rms of the weld current. Accordingly, it is respectfully submitted that claim 95 and claims 96-100 that depend therefrom are in condition for allowance.

Claim 101 as originally filed calls for a digital processor with an algorithm to calculate a rms value for the weld current based upon said samples and said number. Kiyohara calculates a value for the arc current portion of the weld current, and both Kiyohara and Joseph teach away from calculating an rms value for the weld current. Accordingly, it is respectfully submitted that claim 101 and claims 102-106 that depend therefrom are in condition for allowance.

Claim 107 as originally filed calls for sampling the weld current of said waveform at a given rate; creating an event signal at a given location in said waveform; counting the number of samples between successive event signals; and, calculating a rms value for the weld current based upon said samples and said number. Kiyohara does not calculate a rms value for the weld current, but rather only calculates a pseudo-rms value for the arc current portion. Accordingly, it is respectfully submitted that claim 107 and claims 108-112 that depend therefrom are in condition for allowance.

For at least the foregoing reasons, it is respectfully submitted that claims 1-54, 65-76, 81-112, and 139-140 as set forth herein patentably distinguish over the references of record. Accordingly, Applicants ask for allowance of claims 1-54, 65-76, 81-112, and 139-140 as set forth herein.

New Claims 141-153 are in condition for allowance

It is respectfully submitted that of the new claims 141-153, at least new claims 141, 142, 147, 148, 152, and 153 read upon elected Species 1 of FIGURE 1. Claims directed toward control of wire feed speed are supported at least by Fig. 16 and at least at page 33 lines 6-18.

Claim 141 calls for, among other elements, a digital controller that digitally constructs at least one rms signal from digitally squared values acquired over at least

one period of the current waveform, the at least one rms signal being representative of the at least one weld parameter over the at least one period of the current waveform. The "rms" signal of Kiyohara is not representative of weld current over the at least one period of the current waveform, but rather over only the arc current portion.

Claim 141 further calls for, among other elements, the digital controller to generate at least one weld control signal based on the at least one digitally constructed rms signal. Both Kiyohara and Joseph teach away from constructing a control signal based on an rms signal that is representative of the at least one weld parameter over the at least one period of the current waveform. Kiyohara teaches to instead control based only on the arc current portion. Joseph expressly cautions against controlling based on rms signal values.

Claim 142 calls for the at least one weld parameter to include at least weld current, and for the at least one rms signal to include an rms current representative of the weld current over the at least one period of the current waveform. Kiyohara calculates a value representative of only the arc current portion of the weld current.

Upon allowance of a generic claim Applicants would be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 C.F.R. § 1.141. Accordingly, upon allowance of claim 141 Applicants respectfully request consideration and allowance of dependent claims 143-146.

Claim 147 calls for, among other elements, a digital controller that (i) digitally computes at least one root-mean-square (rms) value corresponding to the at least one monitored weld parameter in which the mean is taken over a contiguous time interval spanning at least one period of the waveform and (ii) computes, based on the at least one rms value, at least one control signal that is input to the at least one control signal input of the power source.

Kiyohara does not compute an rms value in which the mean is taken over a contiguous time interval spanning at least one period of the waveform. Rather, Kiyohara takes the mean over only the arc current portion of the current waveform. Both Kiyohara and Joseph teach away from computing a control signal based on an rms value.

Upon allowance of a generic claim Applicants would be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 C.F.R. § 1.141. Accordingly, upon allowance of claim 147 Applicants respectfully request for

consideration and allowance of dependent claims 148-153.

For at least the foregoing reasons, it is respectfully submitted that new claims 141-153 patentably distinguish over the references of record. Accordingly, Applicants ask for reconsideration and allowance of claims 141-153.

CONCLUSION

Applicants respectfully submit that claims 1-54, 65-76, 81-112, and 139-153 as set forth herein patentably distinguish over the references, and respectfully ask for allowance of claims 1-54, 65-76, 81-112, and 139-153 as set forth herein.

Respectfully submitted,

FAY, SHARPE, FAGAN,
MINNICH, & McKEE, LLP

Date: Sept. 21, 2005

Robert M. Sieg

Robert M. Sieg
Reg. No. 54,446
1100 Superior Avenue
Seventh Floor
Cleveland, Ohio 44114-2518
(216) 861-5582

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